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Ms. Marlene H. Dortch
Secretary
Federal Communications Commission
445 12th Street, SW
Washington, DC 20554

Re: ***Ex Parte* Presentation in MM Docket No. 93-177**
AM Directional Antenna Performance Verification Coalition

Dear Ms. Dortch:

The AM Directional Antenna Performance Verification Coalition ("Coalition") hereby requests that the Federal Communications Commission ("FCC") refresh the record in its long-pending Further Notice of Proposed Rulemaking in MM Docket No. 93-177, *An Inquiry Into the Commission's Policies and Rules Regarding AM Radio Service Directional Antenna Performance Verification*, 16 FCC Rcd 5635 (2001) ("FNPRM"), that was initiated in order to consider the use of computer modeling as a means of verifying AM directional antenna performance. The Coalition submits that in the intervening years since the release of the FNPRM, modern computerized methods of antenna pattern prediction have advanced to the point where computer modeling and internal array parameter monitoring can and should be relied on to verify the performance of most, if not all, medium wave antenna systems.

The Coalition consists of the undersigned broadcasters, broadcast engineering consultants, and broadcast equipment manufacturers, all of whom are experts in the science of AM directional antenna design and have extensive experience in the adjustment and maintenance of AM directional arrays. The members of the Coalition therefore are uniquely qualified to propose these long overdue changes to the AM technical rules.

Over the past five months, members of the Coalition, together with a wide range of other technical experts representing the broadcast, broadcast engineering and equipment manufacturing industries, have participated in a series of *ad hoc* meetings to discuss the practicality of "method of moments" modeling of AM directional antenna arrays and the structures that may impact the performance of those arrays. On the basis of these meetings, the Coalition has drafted modifications to existing FCC rules and proposed new rules that would permit the use of computer modeling using moment method analysis to proof and maintain AM

directional antenna arrays. The proposed rules and rule modifications also would permit the use of computer modeling to evaluate the effects of potential nearby reradiating objects on AM antenna systems. The Coalition respectfully request that these proposed rules and rule modifications be released for public comment in connection with this proceeding.

The fundamental purpose of requiring the verification of antenna system performance is to ensure that the antenna system as constructed continues to satisfy the conditions of the original allocation analysis. However, the present process of relying on field strength measurements to verify antenna system performance is fundamentally flawed, particularly in urban areas and other realistic environments where field strength measurements are especially unreliable. As the FCC is well aware, field strength measurements are subject to variation caused by, among other things, proximity effects, scattering, seasonal changes in ground conductivity, and land development along propagation paths. The ambiguous nature of the measured data necessarily results in an oversimplified analysis. Indeed, any attempt to perform a meaningful statistical analysis on the relatively small number of data points plotted along one measurement radial is doomed by the large number of variables that may have influenced that data.

In contrast, computer modeling using method of moments analysis, such as Numerical Electromagnetic Code ("NEC") or MININEC programs, does not rely on the oversimplified assumptions contained in the FCC's current rules and therefore can be relied on to predict accurately the relationship between pattern shape and internal array parameters such as impedances, currents, and voltages at locations within the power distribution and radiation system. These programs use the current flowing in each tower of an AM directional antenna to predict the electric and magnetic fields that will be produced by that tower, which then can be used to predict accurately the current that will induced by this field into the other towers. By performing this analysis for each tower in an AM directional array, and then combining the fields created by each tower, the programs can accurately predict how the overall AM antenna system will perform.

Broadcast engineers increasingly rely on method of moments analysis for the design and implementation of antenna systems of all types, particularly for medium wave antenna systems. In addition, FCC staff routinely evaluate proposals for unusual AM antenna systems using NEC and MiniNEC programs, and either evaluate or accept evaluations of proximity corrections, issues relating to broadcast station construction near or installation on AM broadcast towers under Section 73.1692, and even current distribution and near-field measurements based on method of moments models.

There was extensive support among the representatives of the broadcast, broadcast engineering, and equipment manufacturing industries that participated in the *ad hoc* meetings for the adoption of rules that would permit the use of computer modeling under these circumstances. On the basis of these discussions, members of the Coalition have prepared draft modifications to existing rules and proposed new rules that would permit the use of computer modeling using

moment method analysis to proof and maintain AM directional antenna arrays and to evaluate the effects of potential nearby reradiating objects on AM antenna systems. These proposed rule changes are summarized briefly below.

- Section 73.151. Directional Antenna Performance Verification

Modified Section 73.151 permits the verification of performance of an AM directional antenna system either by computer modeling and sample system verification or by the performance of field strength measurements. The proposed rule modification specifies the computer modeling parameters to be employed.

- Section 73.155. Periodic Directional Antenna Performance Recertification

New Section 73.155 requires that any AM station that is licensed with a directional antenna pattern pursuant to a proof of performance using moment method modeling and internal array parameters to recertify the performance of that directional antenna pattern at least once within each 24 month period.

- Section 73.61. AM Directional Antenna Field Strength Measurements

Section 73.61 has been modified to reflect that the FCC has the authority to require an AM station to conduct either a partial proof of performance using field strength measurements pursuant to Section 73.154 or a full proof of performance using computer modeling and sample system verification pursuant to Section 73.151 whenever there is an indication that the AM station's antenna is not operating as authorized.

- Construction near or installation on an AM broadcast antenna system or tower

This new rule is designed to harmonize the disparate treatment afforded under Section 22.371, Section 27.63, and Section 73.1692 with respect to disturbances caused to AM stations as a consequence of construction near or installation on an AM broadcast antenna system or tower. The Coalition proposes that this new rule replace Section 22.371, Section 27.63, and Section 73.1692, and be included under Part 17.

* * *

It has been more than six years since the FCC issued the FNPRM on the use of computer modeling to predict directional antenna performance of AM antennas. Since that time, the technology underlying modern computerized methods of antenna pattern prediction has become both widely accepted and utilized in the broadcast industry. The Coalition submits that it is time for the FCC to discontinue its reliance on field strength measurements as the sole method to verify the performance of AM directional antenna systems. Permitting the use of computer

modeling as described in these proposed rules will result in improved adjustments in AM directional patterns and more stable AM directional antenna arrays.

The new and modified rules proposed herein by the Coalition have been drafted on the basis of the input from a wide range of technical experts representing the broadcast, broadcast engineering and equipment manufacturing industries. The Coalition welcomes the opportunity for public comment on these rules.

Respectfully submitted,

AM DIRECTIONAL ANTENNA PERFORMANCE VERIFICATION COALITION

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Broadcasters

Beasely Broadcast Group, Inc.
Bonneville International
Buckley Broadcasting Corporation
CBS Radio Inc.
Citadel Broadcasting Company
Clear Channel Radio
Cox Radio, Inc.
Crawford Broadcasting Company
Cumulus Media Inc.
Entercom Communications Corp.
Entravision Communications Corporation
Family Stations, Inc.
Journal Broadcast Group
Lincoln Financial Media
Morris Communications Company, LLC
Multicultural Radio Broadcasting, Inc.
Peak Broadcasting LLC
Regent Communications
Salem Communications Corporation

Consulting Engineers/Equipment Manufacturers

Carl T. Jones Corporation
Cavell, Mertz & Associates, Inc.
Communications Technologies, Inc.
du Triel, Lundin & Rackley, Inc.
Edward A. Schober, P.E., Radiotechniques Engineering, LLC, Consulting Engineers
Hammett & Edison, Inc.
Hatfield & Dawson Consulting Engineers, LLC
Khanna & Guill, Inc.
Radiotechniques Manufacturing, LLC
Sellmeyer Engineering

PROPOSED REVISIONS TO SECTION 73.151

Directional Antenna Performance Verification

§73.151 Directional Antenna Performance Verification.

The performance of a directional antenna system may be verified either by computer modeling and sample system verification or by the performance of field strength measurements.

(a) *Computer modeling and sample system verification of modeled parameters to establish operation of directional antennas consistent with the theoretical pattern.* Each element of the directional array shall be modeled by use of a method of moments computer program, using element physical characteristics to establish a system model that does not violate any of the constraints of the computer program used.

(1) A matrix of impedance measurements at the base and/or feed point of each element in the array, with all other elements shorted and/or open circuited at their respective measurement locations shall be made. The physical model of the individual antenna elements used in the computer program may be varied to match the measured impedance matrix, but the actual spacings and orientations of the array elements must be used. Towers may be modeled using individual vertical wires to represent them or with multiple wires representing their leg and cross member sections. The resulting model description (consisting of the length, radius and number of segments of each wire for arrays using vertical wire sections to represent the towers, or the length, end-point coordinates and radius of each wire used to represent leg and cross-member sections for arrays using wire tower structure representations) as well as the assumed input feed and base region stray reactances shall be used to generate the drive impedances and sample system parameter values for the operating directional antenna pattern parameters.

(i) For arrays using vertical wires to represent each tower, the radii of cylinders shall be no less than 80% and no more than 150% of the radius of a circle with a circumference equal to the sum of the widths of the tower sides.

(ii) For arrays using multiple wires representing their leg and cross member sections, the individual legs of the tower may be modeled at their actual diameters with appropriate interconnecting segments representing cross members at regular intervals.

(iii) No less than 1 segment for each 10 electrical degrees of the tower's physical height shall be used for each element in the array.

(iv) Base calculations shall be made for a reference point at ground level or within one electrical degree elevation of the actual feed point.

(v) For uniform cross section towers represented by vertical wires, each wire used for a given tower shall be within 75% to 125% of the physical length represented.

(vi) For self-supporting towers, stepped-radius wire sections may be employed to simulate the physical tower's taper, or the tower may be modeled with individual wire sections representing the legs and cross members.

(vii) The lumped series inductance of the feed system between the output port of each antenna tuning unit and the associated tower shall be no greater than 10 uH unless a measured value from the measurement point to the tower base with its insulator short circuited is used.

(viii) The shunt capacitance used to model base region effects shall be no greater than 250 pF unless the measured or manufacturer's stated capacitance for each device other than the base insulator is used. The total capacitance of such devices shall be limited such that in no case will their total capacitive reactance be less than 5 times the magnitude of the tower base operating impedance without their effects being considered.

(ix) The orientation and distances among the individual antenna towers in the array shall be confirmed by a post-construction certification by a Land Surveyor (or, where permitted by local regulation, Engineer) licensed or Registered in the State or Territory where the antenna system is located.

(2)(i) The computer model, once verified by comparison with the measured base impedance matrix data, shall be used to determine the appropriate antenna monitor parameters. The samples used to drive the antenna monitor may be current transformers at the output of the antenna matching networks, voltage samples obtained from a voltage sampler electrically connected across the base insulator of the antenna tower, or sample loops located on the tower. If sample loops are used, they shall be located at the elevation where the current in the tower would be at a minimum if the tower were detuned in the horizontal plane, as determined by the moment method model parameters used to determine the antenna monitor parameters. Sample loops may be employed only when the towers are identical in cross-sectional structure, including both leg and cross member characteristics; if the towers are of unequal height, the sample loops shall be mounted identically with respect to tower cross members at the appropriate elevations above the base insulator. Sample lines from the sensing element to the antenna monitor must be equal in both length (within one electrical degree) and characteristic impedance (within two Ohms), as established by impedance measurements, including at the open-circuit resonant frequency closest to carrier frequency to establish length, at frequencies corresponding to odd multiples of 1/8 wavelength immediately above and below the open circuit resonant frequency closest to carrier frequency, while open circuited, to establish characteristic impedance, and at carrier frequency or, if necessary, at nearby frequencies where the magnitude of the measured impedance is no greater than 200 ohms with the sampling devices connected. Samples may be obtained from current transformers at the output of the antenna coupling and matching equipment for base-fed towers whose actual electrical height is 120 degrees or less, or greater than 190 electrical degrees. Samples may be obtained from base voltage sampling devices at the output of the antenna coupling and matching equipment for base-fed towers whose actual electrical height is greater than 105 degrees. Samples obtained from sample loops located as described above can be used for any height of tower. For towers using base current or base voltage sampling derived at the output of the antenna coupling and matching equipment, the sampling devices shall be disconnected and calibrated by measuring their outputs with a common reference signal(a current through them or a voltage across them, as appropriate) and the calibration must agree within the manufacturer's specifications.

(ii) Proper adjustment of an antenna pattern shall be determined by correlation between the measured antenna monitor sample indications and the parameters calculated by the method of moments program, and by correlation between the measured matrix impedances for each tower and those calculated by the method of moments program. The antenna monitor sample indications must be initially adjusted to agree with the moment method model within +/- 5 percent ratio and +/- 3 degrees phase. The measured matrix impedances must agree with the moment method model within +/- 2 ohms and +/- 4% resistance and reactance.

(3) Reference field strength measurement locations shall be established in directions where the standard pattern unattenuated field strength is within 3 dB of the value for each pattern minimum and the absolute pattern maximum. The field strength shall be measured at each reference location at the time of the proof of performance and its value, along with a complete description of the location, shall be placed in the station's public inspection file.

(b) *Field strength measurements to establish performance of directional antennas.*

(1) In addition to the information required by the license application form, the following showing must be submitted to establish, for each mode of directional operation, that the effective measured field strength (RMS) at 1 kilometer (km) is not less than 85% of the effective measured field strength (RMS) specified for the standard radiation pattern, or less than that specified in §73.189(b) for the class of station involved, whichever is the higher value, and that the measured field strength at 1 km in any direction does not exceed the field shown in that direction on the standard radiation pattern for that mode of directional operation:

(i) A tabulation of inverse field strengths in the horizontal plane at 1 km, as determined from field strength measurements taken and analyzed in accordance with §73.186, and a statement of the effective measured field strength (RMS). Measurements shall be made in the following directions:

(A) Those specified in the instrument of authorization.

(B) In major lobes. Generally, one radial is sufficient to establish a major lobe; however, additional radials may be required.

(C) Along additional radials to establish the shape of the pattern. In the case of a relatively simple directional antenna pattern, a total of six radials is sufficient. If two radials would be more than 90 degrees apart, then an additional radial must be specified within that arc. When more complicated patterns are involved, that is, patterns having several or sharp lobes or nulls, measurements shall be taken along as many as 12 radials to definitely establish the pattern(s). Pattern symmetry may be assumed for complex patterns which might otherwise require measurements on more than 12 radials.

(ii) A tabulation of:

(A) The phase difference of the current in each element with respect to the reference element,

and whether the current leads (+) or lags (-) the current in the reference element, as indicated by the station's antenna monitor.

(B) The ratio of the amplitude of the radio frequency current in each element to the current in the reference element, as indicated on the station's antenna monitor.

(iii) A monitoring point shall be established on each radial for which the construction permit specifies a limit. The following information shall be supplied for each monitoring point:

(A) Measured field strength.

(B) An accurate and detailed description of each monitoring point. The description shall include, but shall not be limited to, geographic coordinates determined with a Global Positioning System receiver.

(C) Clear photographs taken with the field strength meter in its measuring position and with the camera so located that its field of view takes in as many pertinent landmarks as possible.

(2) For stations authorized to operate with simple directional antenna systems (e.g., two towers) in the 1605-1705 kHz band, the measurements to support pattern RMS compliance referred to in paragraphs (b)(1)(i)(B) and (b)(1)(i)(C) of this section are not required. In such cases, measured radials are required only in the direction of short-spaced allotments, or in directions specifically identified by the Commission.

PROPOSED NEW RULE

SECTION 73.155

Periodic Directional Antenna Performance Recertification

73.155 Periodic Directional Antenna Performance Recertification

A Station licensed with a directional antenna pattern pursuant to a proof of performance using moment method modeling and internal array parameters as described in §73.151(a) shall recertify the performance of that directional antenna pattern at least once within every 24 month period.

(a) Measurements shall be made to verify the continuing integrity of the antenna monitor sampling system.

(1) For towers using base current or base voltage sampling derived at the output of the antenna coupling and matching equipment, the sampling devices shall be disconnected and calibrated by measuring their outputs with a common reference signal (a current through them or a voltage across them, as appropriate) and the calibration must agree with the manufacturer's specifications.

(2) For towers using base current or base voltage sampling derived at the output of the antenna coupling and matching equipment, sampling line measurements shall be made to verify the open-circuit resonant frequency closest to carrier frequency, to establish length, and also at frequencies corresponding to odd multiples of 1/8 wavelength immediately above and below the open-circuit resonant frequency closest to carrier frequency, while open circuited, to verify their characteristic impedance. The frequencies measured must be the same as were measured in the most recent proof of performance and must demonstrate that the sampling lines continue to meet the requirements of §73.151(a) with regard to their length and characteristic impedance.

(3) For towers having sampling loops, measurements shall be made at carrier frequency or, if necessary, at nearby frequencies where the magnitude of the measured impedance is no greater than 200 ohms with the sampling loops connected. The frequencies measured must be the same as were measured in the most recent proof of performance and the measured impedances must agree within +/- 2 ohms and +/- 4% resistance and reactance of the proof values.

(b) Field strength measurements shall be made at the reference field strength measurement locations that were established by the most recent proof of performance. If locations have become inaccessible or their readings contaminated by localized electromagnetic environmental changes, new locations that meet the requirements of the moment method proof of performance rules in 73.151(a)(3) shall be established to replace them.

(c) The results of the periodic directional antenna performance recertification measurements shall be retained in the station's public inspection file.

PROPOSED REVISIONS TO SECTION 73.61

AM Directional Antenna Field Strength Measurements

Section 73.61 AM directional antenna field strength measurements.

(a) Each AM station using a directional antenna with monitoring point locations specified in the instrument of authorization must make field strength measurements as often as necessary to ensure that the field at those points does not exceed the values specified in the station authorization. Additionally, stations not having an approved sampling system must make the measurements once each calendar quarter at intervals not exceeding 120 days. The provision of this paragraph supersedes any schedule specified on a station license issued prior to January 1, 1986. The results of the measurements are to be entered into the station log pursuant to the provisions of §73.1820.

(b) If the license for an AM stations was granted on the basis of field strength measurements performed pursuant to §73.151(b), partial proof of performance measurements using the procedures described in §73.154 must be made whenever the licensee has reason to believe that the radiated field may be exceeding the limits for which the station was most recently authorized to operate.

(c) A station may be directed to make a partial proof of performance pursuant to §73.154 or a full proof of performance pursuant to §73.151(a) by the FCC whenever there is an indication that the antenna is not operating as authorized.

PROPOSED NEW RULE

UNDER PART 17

Construction Near or Installation on an AM Broadcast Antenna System or Tower

Part 17

Construction near or installation on an AM broadcast antenna system or tower.

(a) *Construction near an AM broadcast antenna system.* All Commission licensees that construct or make a significant modification to an antenna tower or support structure in the immediate vicinity of an AM antenna system are responsible for measures necessary to correct disturbances of the AM antenna radiation pattern that causes operation of the AM station outside of the radiation parameters specified by the FCC, if the disturbance occurs as a result of such construction or modification. The proponent of such construction or modification shall notify the licensee of the AM station in advance of the proposed construction or modification.

(1) In most cases, the addition of one or more antennas to an existing antenna tower or support structure will not affect a nearby AM antenna system. A significant modification to an antenna tower or support structure is defined as follows:

(i) with respect to an antenna tower or support structure that is in the immediate vicinity of an AM antenna system, any change, including the addition or removal of an antenna or mounting platform, that would alter the structure's effective electrical height by 5 degrees or more at the AM station's carrier frequency, as determined by moment method analysis; or

(ii) the addition of one or more antennas or a transmission line to an antenna tower that has been detuned or base-insulated in order to prevent disturbances of the radiation pattern of such AM antenna system as a result of the requirements of this section, or a previously applicable FCC rule.

(2) An antenna tower or support structure is in the immediate vicinity of an AM antenna system if it is greater than 60 electrical degrees in height in the case of a nondirectional antenna, or 45 electrical degrees in height in the case of a directional antenna, at the AM station frequency, and is located at a distance no greater than the lesser of 10 wavelengths or 3 km from any element of an AM directional antenna or less than 1 wavelength from an AM omnidirectional antenna.

(3) Licensees proposing construction of or a significant modification to an existing antenna tower or support structure in the immediate vicinity of an AM antenna system shall examine the potential effects thereof using a moment method analysis. The moment method analysis shall consist of a model of the AM antenna together with the potential reradiating antenna tower or support structure in a lossless environment. The construction or modification shall be deemed to have no adverse affect on the AM antenna system, and no remedial measures will be required, if the model shows that:

(i) the omnidirectional radiation pattern of the AM station would not be made non-circular by more than 2 dB; or

(ii) the theoretical radiation pattern of an AM directional antenna would not be distorted outside the licensed standard or augmented radiation pattern.

With respect to an AM station that was authorized pursuant to a directional proof of performance conducted with field strength measurements, the proponent of the construction or modification may, in lieu of the showing described in Paragraph (3)(ii), demonstrate through measurements taken both prior to and upon completion of the construction or modification that (A) the monitor point values of the AM directional antenna do not exceed the licensed values, or (B) in the event that the pre-construction or modification monitor point values exceed the licensed values, the post-construction or modification monitor point values do not exceed the pre-construction or modification monitor point values. Alternatively, the proponent may file for authority to increase the relevant monitor point value after performing a partial proof of performance in accordance with §73.154 that establishes that the licensed radiation limits on the applicable radial are not exceeded.

(4) Absent a showing of no adverse affect as described in Paragraph 3, the proponent of the construction or significant modification shall be responsible for the installation and continued maintenance and proper operation of any detuning apparatus necessary to restore proper performance of the AM antenna system.

(b) *Installation on an AM antenna tower.* A licensee of an AM station employing an omnidirectional antenna shall conduct an antenna impedance measurement after the completion of construction, and if the results show changed conditions, the licensee shall file an application on FCC Form 302-AM to return to direct power measurement. Prior to commencing construction, the licensee of an AM station employing a directional array shall request Special Temporary Authority pursuant to §73.1635 for operation of the antenna system. If the construction and any necessary adjustments to the antenna system result in antenna monitor parameters that are not within the tolerances specified by §73.62(a) or, where applicable, monitor point field strength limits specified in the station license, an application on FCC Form 302-AM (including a tower sketch of the installation) shall be filed with the Commission for the AM station, including antenna measurements as follows:

(1) if the license was granted pursuant to a proof of performance employing field strength measurements, a partial proof of performance (as defined by §73.154(a)); or

(2) if the license was granted pursuant to §73.151(a), a new analysis using the modified antenna characteristics shall be performed in accordance with that section.